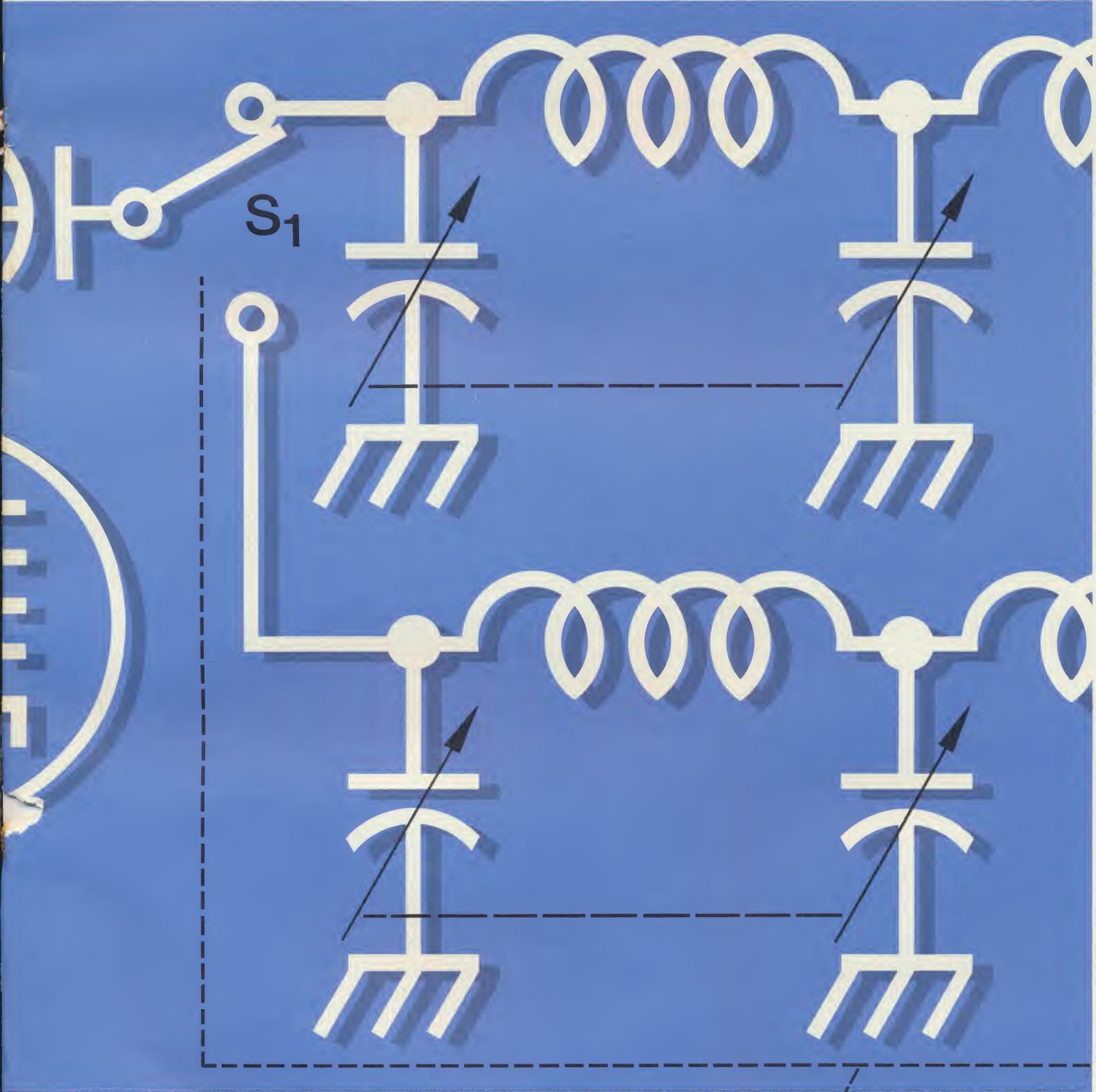


# HF transmitting and receiving systems

Granger  
Associates

SHORT FORM CATALOG / JUNE, 1967



## Introduction

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**NEW HF SYSTEMS FOR THE PROFESSIONAL COMMUNICATOR FEATURE SUPERIOR G/A DESIGN AND PERFORMANCE** The new HF receivers, transmitters, and associated equipment shown here are for people whose messages must get through in real time: now. In point-to-point, ground/air and shore/ship systems, extended radiotelephone service, and HF teletype circuits, they keep military and civilian aircraft on the beam, businessmen informed, and newspapers up-to-the-minute. They serve people who literally cannot afford unnecessary outages or garbling.

G/A can furnish an entire HF system, including antennas and interface equipment. Or G/A can provide the HF components and the systems engineering needed to help you expand your present system.

Additional technical information is available for each of the system components in this catalog. Please write to Granger Associates, 1601 California Avenue, Palo Alto, California 94304.

**HF RECEIVERS /****MODEL 351**

8 channel

**MODEL 353**

single channel

Two G/A receivers offer the HF communicator new capability. Both models operate in frequencies from 1.65 to 40 MHz. The all-silicon solid-state construction provides high reliability, compact size, long life and low power consumption.

The standard 8-channel Model 351 operates in the AM, SSB, or CW modes (switch selectable), and with the G/A Adapters it also operates in the FSK or ISB modes. Any of these modes is available as an option for the single-channel unit, Model 353.

Both receivers can be used in point-to-point, ground/air, or shore/ship communications, thin-line radiotelephone service, as emergency backup and for frequency monitoring. Their frequency range can be modified to 200 to 500 KHz for marine applications. The single-channel unit is ideal for continuous monitoring and needs little attention from the operator. Its only controls are RF Gain and Audio Line Level.

G/A receivers offer clearer communications reception because their design provides dynamic range of 100 db. Intermodulation distortion is better than 40 db. They are particularly valuable in areas of high HF congestion because they are im-

age-free. Innovations in circuit design have eliminated the need for an RF stage so that distortion due to overload is virtually eliminated. Receivers include a steering diode circuit to provide *no-break* operation from dc battery power in the event of an ac power failure.

A high degree of system flexibility is ensured by the wide range of options and accessories available. For instance, the FSK adapter (see page 4) is particularly useful for TTY reception in newspaper offices, meteorological centers, commercial point-to-point networks and in law enforcement. In addition, the Model 351 is available in a remote control version, Model 351R. This unit features quick remote tuning in less than 0.5 sec per operation.



Model 351 HF Receiver



Model 353 HF Receiver

**SPECIFICATIONS / G/A RECEIVERS****Model 351**

NUMBER OF CHANNELS:

Eight

FREQUENCY RANGE:

1.65 to 40 MHz

OPERATING MODES:

USB, LSB, AM, and CW with BFO selected by panel switch. FSK and ISB with accessory adapters.

FREQUENCY STABILITY:

±1 ppm from 0 to 55°C

SENSITIVITY:

.5 microvolt for 10 db signal + noise-to-noise ratio in SSB mode.

INPUT IMPEDANCE:

50 ohms

POWER REQUIREMENTS:

115/230 v 50/60 Hz.  
24 watts  
12/24 vdc 20 watts

OPTIONS:

Switch selection of up to four filters to be used with USB, LSB, AM, CW, or FSK modes as required.

CW BFO

200 to 500 KHz band coverage

ACCESSORIES:

FSK Demodulator (Model 355)  
ISB Adapter (Model 358)  
Remote Control modification kit (Model 351R)  
Remote Control Console (Model 357)  
Audio Amplifier and Speaker Panel (Model 348)**Model 353**

One

1.65 to 40 MHz

USB or LSB or AM or CW with BFO. FSK and ISB with accessory adapters.

±1 ppm from 0 to 55°C

.5 microvolt for 10 db signal + noise-to-noise ratio in SSB mode.

50 ohms

115/230 v 50/60 Hz.  
24 watts  
12/24 vdc 20 watts

Any one filter may be installed to provide for USB, LSB, AM, CW, or FSK modes.

CW BFO

200 to 500 KHz band coverage

FSK Demodulator (Model 355)  
ISB Adapter (Model 358)  
Audio Amplifier and Speaker Panel (Model 348)

## HF RADIO TRANSMITTERS

The new G/A TRANSMITTERS are designed for point-to-point, ground/air, shore/ship, thin-line radiotelephone systems and TTY communications. New transmitters are available with power outputs of 5 kw, 3 kw, 1 kw and 500 watts.

Several design innovations have been used to assure high performance and long-term reliability in all G/A TRANSMITTERS. Broadband design in the exciter and driver eliminates the need for tuning in these stages. Only four tuning adjustments, all in the final stage, are needed. (Most competitive transmitters require six or more tuning controls.) Special circuits cut spurious signal level to 60 db below PEP. Automatic level control (ALC) limits distortion in peak overdrive conditions. Built-in metering is provided for routine adjustments. Solid state silicon rectifiers are used to ensure reliability.

G/A TRANSMITTERS offer flexibility—operating in the SSB, CW, AME, FSK and ISB modes. Transmitters are available with single channel, two fast-switched channels or 8 channels. All of these units can be remoted with the G/A Model 357 Remote Control System.

Clarity and continuity are vitally important in high-speed data transmission. To meet this need G/A offers the Model 172-2 transmitter, which has two separate plug-in networks for fast switching from one operating frequency to a second frequency *without retuning*. Channels can be switched in less than 50 milliseconds, losing only one character of information. The two networks can be pretuned easily and quickly, and additional networks can be plugged in within a few moments.

The cabinet design and internal layout of G/A TRANSMITTER components offer maximum accessibility. Ample room is allowed for fast servicing if this should become necessary. All major components can be removed, checked and reinstalled without unsoldering and resoldering cables.



Typical G/A HF Radio Transmitter

### HF TRANSMITTERS / SPECIFICATIONS

Model No. and type	Model 172-1 5 kw SSB, continuous tuning	Model 172-2 5 kw SSB, fast-switching, 2-frequency	Model 170-2 3 kw SSB, continuous tuning	Model 181 3 kw SSB, single frequency	Model 180 1 kw SSB, continuous tuning	Model 179 500 watt SSB, continuous tuning
FREQUENCY RANGE	2 to 30 MHz	2 to 40 MHz	2 to 30 MHz	2 to 6 MHz	2 to 30 MHz	2 to 30 MHz
OPERATING MODES	SSB, CW, AME, FSK, ISB	SSB, CW, AME, FSK, ISB	SSB, CW, AME, FSK, ISB	SSB, CW, AME, FSK, ISB	SSB, CW, AME, FSK, ISB	SSB, CW, AME, FSK, ISB
POWER RATING	5 kw PEP, 2.5 kw CW, 1.25 kw AME	5 kw PEP, 2.5 kw CW, 1.25 kw AME	3 kw PEP, 3 kw CW, 750 w AME	3 kw PEP, 1.5 kw CW, 750 w AME	1 kw PEP, 1 kw CW, 250 w AME	500 w PEP, 500 w CW, 125 w AME
OUTPUT IMPEDANCE	50 ohms	50 ohms	50 ohms	50 ohms	50 ohms	50 ohms
POWER REQUIREMENT	230 v, 3 phase, 50/60 Hz	230 v, 3 phase, 50/60 Hz	230 v, 3 phase, 50/60 Hz	230 v, 3 phase, 50/60 Hz	115/230 v, single phase, 50/60 Hz	115/230 v, single phase, 50/60 Hz
DISTORTION PRODUCTS	At least 35 db below 5 kw PEP	At least 35 db below 5 kw PEP	At least 35 db below 3 kw PEP	At least 35 db below 3 kw PEP	At least 35 db below 1 kw PEP	At least 35 db below 500 w PEP
SPURIOUS SIGNALS	At least 60 db below 5 kw PEP	At least 60 db below 5 kw PEP	At least 60 db below 3 kw PEP	At least 60 db below 3 kw PEP	At least 60 db below 1 kw PEP	At least 60 db below 500 w PEP
HARMONIC RADIATION	At least 50 db below 5 kw PEP	At least 50 db below 5 kw PEP	At least 50 db below 3 kw PEP	At least 50 db below 3 kw PEP	At least 50 db below 1 kw PEP	At least 50 db below 500 w PEP
SWITCHING TIME	—	50 milliseconds or less	—	—	—	—
EXCITER	8-channel Model 154	Fast-switching Model 155-2	8-channel Model 154	Single-channel Model 155-1	8-channel Model 154	8-channel Model 154
SIZE	75" H x 34" W x 25½" D (191 cm H x 86 cm W x 65 cm D)	75" H x 34" W x 25½" D (191 cm H x 86 cm W x 65 cm D)	75" H x 34" W x 25½" D (191 cm H x 86 cm W x 65 cm D)	75" H x 24" W x 24" D (191 cm H x 63 cm W x 63 cm D)	42" H x 24" W x 24" D (106 cm H x 63 cm W x 63 cm D)	42" H x 24" W x 24" D (106 cm H x 63 cm W x 63 cm D)
WEIGHT	Approx. 1050 lbs. (476.3 kg)	Approx. 1050 lbs. (476.3 kg)	Approx. 1050 lbs. (476.3 kg)	Approx. 950 lbs. (431 kg)	Approx. 650 lbs. (294 kg)	Approx. 650 lbs. (294 kg)

## ISB RECEIVER ADAPTER / G/A MODEL 358

The G/A Model 358 ISB Adapter allows simultaneous reception of both upper and lower sidebands when used in conjunction with the G/A single- or 8-channel receivers. It also allows over 60 db of independent automatic gain control for the sideband it receives. AGC is selectable for independent control, control slaved to the receiver AGC, or control of the receiver slaved to the Model 358 Adapter.

Construction and printed circuit boards used in the Model 358 are identical to their counterparts in the G/A receivers. This simplifies maintenance and logistics. The Adapter operates on 115/230 volt ac power source.

## ISB TRANSMITTER ADAPTER / G/A MODEL 158

The G/A Model 158 permits simultaneous transmission of information on both sidebands. Independent sideband transmission is usually used for a combination of voice and phone or TTY; since twice as much information can be conveyed at the same time, it has the effect of doubling the transmitter's usefulness.

## FSK DEMODULATOR / G/A MODEL 355

G/A Model 355 is a frequency-shift-keyed (FSK) demodula-

tor that is capable of diversity performance with a single receiver and antenna. When used with the G/A Model 351 receiver, it provides a high stability, multichannel radio teleprinter terminal for newspaper offices, meteorological centers, and commercial point-to-point networks where FSK transmission is monitored continuously.

The Model 355 FSK Demodulator, which features solid-state switching, keys a standard neutral telegraph loop. It has patented detection circuitry to provide performance equal to dual diversity, and a unique "Mark-Hold" circuit which eliminates false starts caused by interference. It also provides maximum discrimination against impulse noise and sudden fades on the "Mark" channel in the absence of keying.

### SPECIFICATIONS / MODEL 355

INPUT IMPEDANCE:	600 ohms
AUDIO INPUT:	0 dbm
AUDIO FREQUENCIES:	2125 cps mark; 2975 cps space
BAUD RATE:	45/50 bauds (60/66 wpm)
FREQUENCY SHIFT:	850 Hz
POWER REQUIREMENTS:	115/230v $\pm 10\%$ , 47/63 Hz
SIZE:	1 $\frac{3}{4}$ " x 10" x 18" (4.44 cm x 25.4 cm x 45.22 cm)
WEIGHT:	10 lbs (4.54 kg)



Model 358 ISB Receiver Adapter



Model 158 ISB Exciter Adapter (Transmitter Adapter)



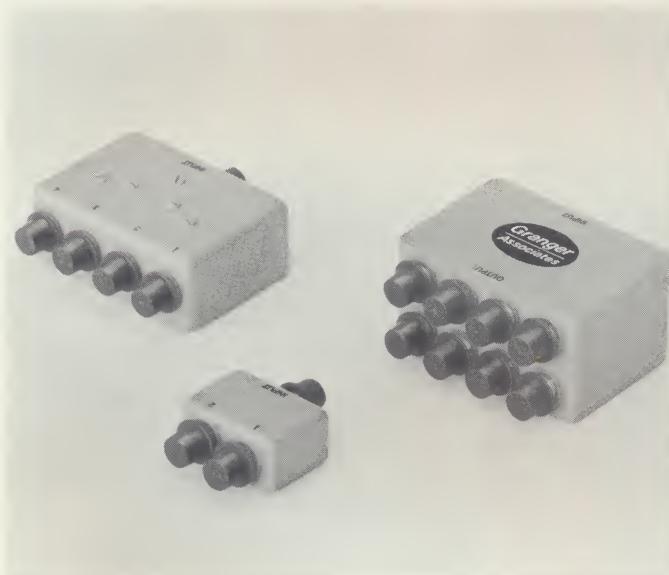
Model 355 FSK Demodulator

## RECEIVING MULTICOUPLERS / G/A MODEL 356

G/A Model 356, a receiving multicoupler, is a passive unit that permits several receivers to be connected to a single antenna. Three standard versions of this multicoupler are available off-the-shelf with 2, 4 or 8 output ports. Intermodulation distortion in these units is negligible. They are hermetically sealed for long, trouble-free service.

### SPECIFICATIONS / MODEL 356

FREQUENCY RANGE:	2 to 32 MHz	
INPUT IMPEDENCE:	50 ohms unbalanced, input/output	
IM:	> 80 db for two 0.25 VRMS signals	
INPUT VSWR:	1.2:1 max	
ISOLATION:	-30 db	
INSERTION LOSS:	3.25 db max, 2 channel 6.5 db max, 4 channel 9.75 db max, 8 channel	
<i>Model 356 No. outputs</i>		
-1	2	All models are mounted on a 3½" x 19" rack. (8.9 cm x 48.2 cm)
-2	4	
-3	8	



Model 356 Receiving Multicouplers

## RECEIVING ANTENNA MATCHING UNITS / G/A MODEL 575

These units match balanced open-wire transmission line to shielded coaxial cable. Design features include low insertion loss, wide frequency range (0.5 MHz to 32 MHz) and weather resistance—the units are hermetically sealed. Six versions are available to match 50- or 75-ohm coax to 200-, 300-, or 600-ohm balanced lines.

### SPECIFICATIONS / MODEL 575

FREQUENCY RANGE:	0.5 to 32 MHz
POWER-HANDLING CAPABILITY:	Receiving level (1 w max.)
INSERTION VSWR:	1.2:1 max
INSERTION LOSS:	Less than 0.45 db (with 1:1 load)
IMPEDANCE TRANSFORMATION RATIO:	
Model 575	Coaxial to balanced
-1	50Ω 200Ω
-2	75 200
-3	50 300
-4	75 300
-5	50 600
-6	75 600
SIZE AND WEIGHT:	2.38" dia. x 5.25" long; approx. 1 lb.



Model 575 Receiving Antenna Matching Unit

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## LOUDSPEAKER AND AUDIO AMPLIFIER PANEL / G/A MODEL 348

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The G/A loudspeaker and audio amplifier panel Model 348 provides monitor capability for HF receivers such as G/A Models 351 and 353. The compact unit is all silicon solid-state and takes 5½" on a standard 19" rack.

### SPECIFICATIONS / MODEL 348

INPUT IMPEDANCE:	10K ohms ungrounded
INPUT LEVEL:	—6 dbm for 1 watt
AMPLIFIER OUTPUT:	2 w into 3 ohms
FREQUENCY RESPONSE:	200-7000Hz —3 db
LOUDSPEAKER:	2 watts, 4" diam
POWER REQUIREMENT:	12/24 v dc or 115/230 v 50/60 Hz
SIZE AND WEIGHT:	5½" H x 19" W x 6" D (13.3 cm x 48.2 cm x 15.2 cm); approx. 10 lbs (4.54 kg)

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## REMOTE CONTROL UNITS / G/A MODELS 357-1 AND 357-2

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Two control systems are available for remote operation of receivers, transmitters and for switching antennas. The G/A consoles provide all the controls and indicators needed to exercise full control over a transmitting/receiving station. The G/A consoles can be expanded to handle any number of remote equipments. The use of a Model 357 remote console allows the optimum distant placement of HF stations with no loss of operating control.

The Model 357-1 is designed to operate on wire systems at distances up to 1,000 feet. The Model 357-2 is a tone-coded system suited to longer haul over leased, microwave or other audio line circuits.

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## G/A TELETRANSCEIVERS™

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G/A TELETRANSCEIVERS fill the previously existing gap between large-scale, heavy-duty professional equipment and amateur instruments. These SSB radiotelephones are designed specifically for commercial/business use and are of professional quality. In addition to their small size and low power consumption, they feature such built-in benefits as automatic level control and automatic gain control.

G/A TELETRANSCEIVERS are particularly well suited to banks and other commercial organizations, as well as to law enforcement agencies. No detailed knowledge of HF communications is needed by the user, and these units deliver full performance within their specifications. Six models are now available:

- 10 watts output, mobile/base station, G/A Model 175-1
- 10 watts output, manpack/mobile, G/A Model 175-2
- 50 watts output, mobile or base station, G/A Model 174
- 100 watts output, base station, G/A Model 176
- 500 watts output, base station, G/A Model 177
- 1000 watts output, base station, G/A Model 178

Solid-state devices and modular construction are features of G/A TELETRANSCEIVERS. All are extremely easy to operate and are system-compatible with the more powerful G/A HF transmitters or receivers for additional power capability.

G/A TELEWRITER (Model 173) is a complete teleprinter sending and receiving terminal. With a power output of 100 watts, it has data transmission rates of 75 bauds or 66 words per minute. It is especially designed for simplex networks. An optional selective calling feature permits as many as 30 users to share a single frequency.



Model 175-1 Teletransceiver



*Model 175-2 Teletransceiver*



*Model 177 or 178 Teletransceiver*



*Model 174 Teletransceiver*



*Model 176 Teletransceiver*



*Model 173 Telewriter*

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## ANTENNAS AND ASSOCIATED EQUIPMENT

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A wide variety of antennas to meet the professional HF communicator's needs is available from Granger Associates. More than 200 models are offered with either directional or omnidirectional characteristics, including log-periodics (both vertically and horizontally polarized), omnidirectional antennas such as the MONOCONE™ and monopole models, steerable L-P arrays, transportable antennas, dipole and whip antennas.

Transmitting multicouplers and baluns are also available in a number of versions. G/A multicouplers, which are passive units, operate in the 2 to 32 MHz frequency range. Model 520G has a power-handling capacity of 20 kw PEP per channel, while that of Model 557 is 40 kw PEP, 20 kw average. Twenty-four versions of these multicouplers are available off-the-shelf. G/A balun transformers range in power from 1 kw average (2 kw PEP) to 50 kw average (200 kw PEP).

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## IONOSPHERE SOUNDERS

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Granger Associates also manufactures a complete line of ionosphere sounders and accessories. For information on synchronized-oblique sounders, request data concerning the PATH-SOUNDER™ III system; for information on a unique research/operations instrument, request data on the Universal Sounder.

### MORE INFORMATION FOR YOU.

Additional information on these products is available from the G/A Communications Engineering office nearest you:

Granger Associates, 1601 California Avenue, Palo Alto, California 94304;

818 18th Street NW, Washington, D. C. 20006;

3025 Garland Terrace, Colorado Springs, Colorado 80910;

444 West Camelback Road, Phoenix, Arizona 85013;

Granger Associates Ltd., Russell House, Molesey Road, Walton-on-Thames, Surrey, England;

Granger Associates Pty. Ltd., 1-3 Dale Street, Brookvale, NSW, Australia.

*Due to product improvements, specifications are subject to change without notice.*



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